Washington State
Hydrogeology of
Washington State

4th Symposium on the

CONFERENCE ANNOUNCEMENT

April 8-10, 2003

Sheraton Tacoma Convention Center, Tacoma, Washington

Register by March 7, 2003

Organized by:

USGS *science for a changing world*

U.S. Geological Survey

Washington State Department of Ecology

Washington Hydrologic Society

national ground water association — it's more than just water

National Ground Water Association

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

http://www.ecy.wa.gov/events/hg

Washington State Department of Ecology
P.O. Box 47775
Olympia, WA 98504-7775

Registration and General Information

Registration deadline: March 7, 2003

Symposium fees:	**Through 3-7-03**	**After 3-7-03**
Symposium Registration	$200.00	$250.00
Student Rate	$100.00	$150.00
Exhibitor Rate (with 1 registration)	$350.00	$400.00

Field trips:

Hanford Field Trip (Sun-Mon, April 6-7)	$175.00
Columbia Basin Hydrogeology (Sun-Mon, April 6-7)	$120.00
Asarco/Tacoma Landfill (Thurs PM, April 10)	$ 25.00

Workshops:	**With Conference Registration**	**Without Conference Registration**
Hazardous Waste Safety Refresher (Mon, April 7, 8 Hours)	$100.00	$130.00
Estimating Remediation time, Thurs. PM, April 10 - See Website.	$ 25.00	N/A

HOW TO REGISTER:

Registration for the 4th Symposium on the Hydrogeology of Washington State is handled electronically through on-line registration. On-line registration can be accessed from the registration link on the Symposium website ***http://www.ecy.wa.gov/events/hg/index.htm*** or the Convention Services Northwest link ***www.regweb.com/csnw/h2o***. Questions or problems with the electronic registration should be directed to Convention Services Northwest (206) 292-0559. All major credit cards are accepted. A confirmation notice will be e-mailed within 48 hours of registration.

DIRECTIONS:

The Sheraton Tacoma Hotel and Convention Center is located at 1320 Broadway Plaza Tacoma, WA, 98402. Directions to the Tacoma Sheraton Convention Center can be obtained on-line at http://www.sheratontacoma.com 253-572-3200 or 800-325-3535.

http://www.ecy.wa.gov/events/hg

FIELD TRIPS:

See insert for field trip details and website for last minute updates.

PARKING:

Parking at the Sheraton is available at the rate of $12 per day. Valet parking is available for $15 per day. The 4th level of the Sheraton lot is the most convenient to the Symposium venue. Handicapped parking is available in the 1st level lot only.

LODGING:

Guest rooms are available at the Sheraton at the following rates:
Single-$115 Double-$125 Triple-$135 Quad-$145
These rates do not include state and local taxes which are 13.5%.
Please identify yourself as a Symposium attendee to qualify for these rates. A block of rooms will be held until 3-16-03. Any reservations after this date may not qualify for the group rate.

MEALS:

Morning and afternoon breaks with refreshments will be provided on each day of the Symposium. Lunch will be provided on Tuesday and Wednesday (April 8 & 9) and dinner will be provided on Tuesday evening (April 8).

STUDENT SCHOLARSHIPS:

A limited number of student scholarships are available with priority given to student presenters. Please contact Gina Mulderig at (253) 843-9268 or Mulderig@nwlink.com for more information.

Donations are being sought to provide student scholarships and pay for session breaks, special events, and field trips. Please contact Jim Goodrich at (360) 202-7073 or moonspun@earthlink.com .

EXHIBITOR INFORMATION:

The technology and trade show will be begin at 7:30 am on Tuesday, April 8, 2003 and will run for the duration of the symposium. Exhibitors are being sought to display their services or products and demonstrate state-of-the-art technology. Exhibitors should contact Gina Mulderig for more information by March 1, 2003.

Gina Mulderig
30013 2nd Av. S., Roy, WA 98580
(253) 843-9268 mulderig@nwlink.com

7:00 AM	**Tuesday, April 8. 2003 - Registration**	
8:00 AM	**Welcome / Keynote: Richelle Allen-King, 2003 Darcy Lecturer - Ground and Surface Water Contributions to Chemical Mass Discharge: Field to Basin Scales**	
9:15 AM	**BREAK**	
9:45 AM	**1A: Geochemistry I**	**1B: Water Availability I**
Session 1	**Anatomy of a Sinking Chlorinated Solvent Plums:** *Dan Matthews and Chip Goodhue, Aspect Consulting, LLC* **Uranium Mobility in Groundwater at the 300 Area of the Hanford Site:** *Jonathan Lindberg and Jeffrey Serne, Pacific Northwest National Laboratory* **Investigation of Contaminant Fate and Transport Beneath Leaked Hanford High-Level Waste Tank:** *Mark Freshley, Pacific Northwest National Laboratory* **Hydrology and MTCA Investigation of a Commercial Low-Level Radioactive Waste Site:** *Zelma Jackson and Tina Heggen, Washington Dept. of Ecology*	**Streamflow Variability, Water Use Impacts and Fish Habitat Requirements, Lower Skagit River Watershed:** *John Koreny, GeoEngineers, Inc.; Charles Lindsay, Hydrologic Services Company; et al.* **Long-Term Ground-Water Hydrograph Analysis for the Palouse Basin Aquifer:** *Farida Leek, Joan Wu, and Kent Keller, Washington State University* **Methods to Estimate Unmetered Ground-Water Withdrawals in the Yakima River Basin, Washington:** *Marcella Ripich, U.S. Geological Survey* **Interpretive Hydrogeology of the Middle Wind River Basin, Skamania County, Washington:** *Said Amali and Steve Misner, et al., Kennedy/Jenks Consultants, Inc.*
11:15 AM	**The Challenges of Water Rights Purchases and Transfers Panel**	**The Contemporary Hydrogeologist Panel**
Panels	**Scott Bender, Moderator - Panel Members TBA**	**Llyn Doremus, Moderator - Panel Memebers TBA**
12:15 PM	**LUNCH**	
01:45 PM	**2A: Geochemistry II**	**2B: Water Availability II**
Session 2	**Heterogeneous Physical and Chemical Aquifer Properties and the Role of Lithofacies in Contaminant Transport:** *D.P. Divine, Pacific Groundwater Group; R.M. Allen-King, Washington State University; et al.* **Occurrence and Distribution of Trace Elements in Lake Roosevelt Beach and Bed Sediments, and Air:** *Michael Majewski and Sue Kahle, U.S. Geological Survey* **Natural Hydrogeochemical Controls on Groundwater in the Union River Watershed, Kitsap County, Washington:** *S.D. Warner, Geomatrix; M. Verwiel, Waste Management; et al.* **Age of Ground Water in the Puget Sound Area:** *Steve Cox, U.S. Geological Survey*	**Glacier Mass Balance and Hydrology in the North Cascades:** *Edward Josberger and William Bidlake, U.S. Geological Survey* **Groundwater Management – Snohomish County's Story:** *Jalyn Cummings, Snohomish County Public Works* **Impervious Surface Blocks Infiltration: Good Science or Urban Legend:** *Jeffrey Kirtland, Snohomish County Surface Water Management* **Water Resources of the Ground-Water System in the Unconsolidated Deposits of the Colville River Watershed, Stevens County, Washington:** *Sue Kahle, U.S. Geological Survey*
03:15 PM	**BREAK**	
03:45 PM	**3A: Hydrogeology I**	**3B: Surface-Water / Ground-Water Interaction I**
Session 3	**The Hydro-Potential (HP) Value: A Rock Classification Technique Used For Estimating Ground-Water Seepage Into Rock Excavations:** *William Gates, Kleinfelder, Inc.* **Natural Gas Storage in Basalt Aquifers of the Columbia Basin: Water Resource Considerations:** *Vernon Johnson and Charissa Chou, et al., Pacific Northwest National Laboratory* **Natural Gas Storage in Basalt Aquifers of the Columbia Basin: Hydrogeology Considerations:** *Frank Spane and Vernon Johnson, et al., Pacific Northwest National Laboratory* **Hydrogeological Characterization of Groundwater Flow in the Columbia River Basalt Group using an Integrated Tool Box: Stratigraphic Mapping, Pressure Derivative Pumping Test Analysis, and Geophysical Surveys:** *David Banton, Golder Associates Inc.*	**Total Maximum Daily Load (TMDL) Study of the Quality of the Groundwater Discharge to Moses Lake, Washington:** *Charles Pitz, WA Dept. Of Ecology* **Radiological and Chemical Contaminants Entering the Near-Shore Environment of the Columbia River at the Hanford Site's 300 Area:** *G.W. Patton, Pacific Northwest National Laboratory; S.P. Van Verst, WA Dept. of Health; et al.* **Tidal Filtering of Pumping Test Data in the Downtown and Elliot Bay Area:** *Dan McHale, and Richard Martin, Shannon & Wilson, Inc.* **Hillside Infiltration - Practical Solution or Slippery Slope:** *Randal Dyer and Brian Hall, HWA GeoSciences, Inc.*
05:15 PM	**Reception / Cash Bar / Authors at Posters**	
06:15 PM	**DINNER**	
7:30 AM	**Wednesday 9, 2003 - Registration**	
8:00 AM	**Keynote: Frank Chapelle: USGS - Estimating Time of Remediation Associated with Monitored Natural Attenuation**	
9:15 AM	**BREAK**	
9:45 AM	**4A: Water Quality / Land Use**	**4B: Public Policy**
Session 4	**Ambient Groundwater Monitoring in King County, Washington:** *Ken Johnson, King County Dept. of Natural Resources & Parks* **Aquifer Storage and Recovery Related Closed System Carbonate Dissolution in the City of Portland Columbia South Shore Well Field:** *Steve Moncaster, Alexis Clark, and Cheryl Ross, Golder Associates Inc.* **The Effects of Three Residential On-Site Sewage Systems on Ground Water Quality:** *Melanie Kimsey and Barbara Carey, WA Dept. of Ecology* **Evaluation of Aquifer Storage and Recovery in the Ahtanum Subbasin using a Groundwater Flow Model:** *Michael Klisch and Christian Pitre, Golder Associates Inc.*	**Getting Together in the Des Moines Creek Basin:** *Susan Everett, WA Dept. of Transportation; Alan Black, HNTB Corporation* **Living with Uncertainty in Resource Management Science:** *Sandy Williamson, U.S. Geological Survey* **Components of a Groundwater Management Plan:** *Carl Hauge, CA Dept. of Water Resources* **Critical Aquifer Recharge Areas:** *Laurie Morgan, WA Dept. of Ecology*
11:15 AM	**Keynote: Nadine Romero - Global Water Resources and the Role of Science in Public Policy**	
12:15 PM	**LUNCH**	
01:45 PM	**5A: Hydrogeology II**	**5B: Surface-Water / Ground-Water Interaction II**
Session 5	**Geologic Mapping of the Columbia Basin Groundwater Management Area: Results and Applications:** *Terry Tolan and Kevin Lindsey, Kennedy/Jenks Consultants, Inc.* **Horizontal and Vertical Datums:** *Russ Darr, WA Dept. of Ecology (Retired)* **Hydrogeologic Characteristics of the Columbia River Basalts near Goldendale, Washington:** *Steve Stresky and Timothy Flynn, Aspect Consulting, LLC* **Hydrologic Controls and Forest Land Management Implications of Deep-Seated Landslides: Examples from Southwest Washington:** *Wendy Gerstel, WA Dept. of Natural Resources; Thomas C. Badger, WA Dept. of Transportation*	**Distribution of Hyporheic Invertebrates in Puget Sound Lowland Streams:** *Anne Weekes, University of Washington* **Impact of Sediment Temperature Gauge Used to Estimate Stream Seepage:** *Bryce Cole, Walla Walla College* **GW Influence on River Water Temperature:** *Llyn Doremus, Nooksack Indian Tribe* **Thermal Transport Investigation Selah Lakes Gravel Mine:** *David Brown, Merideth Gibson, and Wayne Kalbfleisch, David Brown & Associates, Inc.*
03:15 PM	**BREAK**	
03:30 PM	**6A: Geochemistry III**	**6B: Data Base / Decision Support**
Session 6	**Influence of Long Term Precipitation Trends on Landfill Post Closure Ground Water Monitoring Data:** *Arnie Sugar, HWA GeoSciences, Inc.* **Reducing Groundwater Conditions at Forest-Products Industry Sites - Aquifer Geochemistry:** *Glen Wyatt, Weyerhaeuser* **Reducing Groundwater Conditions at Forest-Products Industry Sites - Field Water-Quality Parameter Measurements:** *Glen Wyatt, Weyerhaeuser* **Design and Construction of an Inward Gradient Landfill:** *Kevin Lakey, Kleinfelder, Inc.*	**Ecology's Information Management System — Sharing Environmental Data via the World Wide Web:** *Christine M. Neumiller and John E. Tooley, et al., WA Dept. of Ecology* **Conceptual Model Development for the Sitewide Impact Assessment of the Hanford Site Contamination Using a Holistic System Approach:** *Dibakar (Dib) Goswami, WA Dept. of Ecology* **Using Microsoft Access to Create a Groundwater Pseudo-GIS:** *Douglas Kelly and Gordon Eaton, Island County Health* **A Decision Support System for the Yakima River Basin:** *Mark Mastin and John Vaccaro, et al., U.S. Geological Survey*
05:00 PM	**End of Sessions - break / snacks / posters still up**	
06:00 PM	**Geology evening forum - Kathy Troost**	
7:30 AM	**Thursday April 10, 2003 - Registration**	
8:00 AM	**7A: Hydrogeology III**	**7B: New Technology I**
Session 7	**Hydrogeology of the Hanford Site Vadose Zone:** *Bruce Bjornstad, George Last, and Duane Horton, Pacific Northwest National Laboratory* **Alternative Conceptual Models of Sediment Geometry at the Hanford Site, Southeast Washington:** *C.J. Murray and E. Savelieva, et al., Pacific Northwest National Laboratory* **Geology Architecture Mapping of the Abbotsford-Sumas Aquifer:** *Aparne Desphande and Jacek Scibek, Simon Fraser University; et al.* **Groundwater Implications of the Sub-Vashon Unconformity and other Discontinuities in Quaternary Deposits of the Puget Lowland, Washington:** *Kathy Goetz Troost, University of Washington*	**Near-Real-Time Simulation and Internet-Based Delivery of Forecast-Flood Inundation Maps Using Two-Dimensional Hydraulic Modeling:** *A Pilot Study for the Snoqualmie River, Washington : Joseph Jones, U.S. Geological Survey* **A New Method for Deepening Wells That Are Going Dry:** *Jonathan Lindberg and Ronald Schalla, Pacific Northwest National Laboratory* **Comparison of Field and Laboratory Methods for Detecting Low to Moderate Levels of Arsenic in Soil:** *Norman Hepner and Krystal Rodriguez, et al., WA Dept. of Ecology* **Well Deterioration and Rehabilitation–Extending Efficiency and Effective Life:** *Jim Bailey and Randal Dyer, HWA Beliner Wasser LLC*
9:30 AM	**BREAK**	
9:45 AM	**8A: Modeling**	**8B: New Technology II**
Session 8	**Numerical Modeling to Evaluate Streamflow Effects of a Wet-Pit Aggregate Mines:** *Linton Wildrick, Peter Schwartman, and Russ Prior, Pacific Groundwater Group* **Integration of a Detailed Groundwater Model into a Regional (HSPF) Model:** *Charles Ellingson, Pacific Groundwater Group; Joseph Brascher, Aqua-Terra Associates; Peter Schwartzman, Pacific Groundwater Group* **Application of the Mike SHE Model to Watershed Planning–Little and Middle Spokane WaterSheds:** *Sara Marxen and Bob Anderson, Golder Associates, Inc.; Stan Miller, Spokane County Public Works* **Inverse Modeling of Alternative Conceptual Models of Groundwater Flow at the Hanford Site:** *Tim Scheibe and Charles Cole, et al., Pacific Northwest National Laboratory*	**Hydrofracturing a Shallow Aquitard to Enhance Solvent Recovery:** *Glen Wyatt, Weyerhaeuser; E. Matt Germon, CH2M Hill; et al.* **Field Application of In-Well Aeration System for Perchloroethene Remediation:** *Maura O'Brien and Ben Amoah-Forson, WA Dept. of Ecology; et al.* **Effectiveness of Open Bottomed Sheet Pile Containment Structures in Controlling Groundwater Contamination in a Tidally Fluctuating Aquifer:** *Roy Jensen and Steve Fuller, Weston Solutions, Inc.; et al.* **Remediation of Metals and Organics Through the Use of Electrochemical Remediation Technologies:** *Dr. Falk Doering and Niels Doering, ECP, LLP; et al.*
11:15 AM	**Wrap-up / Door Prizes - End of Day 3**	

WORK & SHOPS
FIELD TRIPS

May be cancelled if to few register. Details will be sent to participants.

WORKSHOP #1

8 Hour Hazardous Waste Safety Refresher Course - April 7

TIME: This 8-hour Hazardous Waste Refresher will be conducted on Monday, April 7th from 8am to 5pm at the Sheraton in Tacoma.

The instructor will be Rick Gleason of Prezant Associates. Rick has been the Senior Safety and Health Consultant for the last 11 years and is a Principal at Prezant Associates in Seattle. Prior to that he worked for OSHA and WISHA as an inspector in Seattle for 13 years. Rick teaches in the graduate program in Industrial Hygiene and Safety at the University of Washington. He is a Certified Industrial Hygienist (CIH) and a Certified Safety Professional (CSP). This 8-hour refresher will not only cover the codes, regulations, specific hazards that hydrogeologists are likely to face, and resources, but will be humorous and enlightening. The course will place special emphasis on hazards which are likely to be encountered by hydrogeologists in the field.

COST PER PERSON: $100 With/registration,
$130 Without/registration
MAXIMUM SIZE: 40 participants; minumum: 20
CONTACT: Gina Mulderig, mulderig@nwlink.com 253-843-9268

WORKSHOP #2

Estimating Remediation Time Using Monitored Natural Attenuation - April 10, Afternoon

Following the close of the symposium, Frank Chapelle, Tuesday's Keynote speaker, will offer a half day short course on using data from monitored natural attenuation to determine the time it will take to remediate a site. Software designed specifically to make these calculations are available at http://www.cee.vt.edu/nas/ and will be discussed.

COST PER PERSON: $25
MAXIMUM SIZE: 30 participants
CONTACT: Sandy Williamson, akwill@usgs.gov
253-428-3600, x2683

FIELD TRIP #1

The Hanford Site, Richland, Washington - April 6 & 7

TIME: The trip departs from Tacoma, at 7am on April 6tb.

Phil Long, Jon Lindberg, and Bruce Bjornstad, will lead this trip. We will drive to the Hanford Site via I-5, White Pass (SR-12), and SR-24 (including a couple of incidental geohydrology stops), entering the Hanford Site from the west via the Yakima Barricade. We will view Hanford Tank Farms containing over half of the high-level radioactive waste in the U.S. and get a panoramic view of the Hanford Site from Gable Mountain. We will drive by LIGO en route to Richland where participants will spend the night at the new User Houser Facility at Pacific Northwest National Laboratory. Before and after a catered dinner at a local winery, participants will be able to sample some of the Northwest's finest wines.

On Monday, participants will begin the day with a continental breakfast at Pacific Northwest National Laboratory's Environmental and Molecular Sciences Laboratory, followed by a short presentation on the geohydrology of the Hanford Site. We will then travel to the 300 Area where a uranium plume is unexpectedly persistent. Subsequent stops will include 100 H and 100 D Areas where a pump and treat and an innovative permeable barrier are used to treat Cr(VI) plumes. We will also view the Columbia River shoreline and discuss approaches used to assess groundwater surface-water interaction and contaminant flux into the river.

We will return to Tacoma at approximately 8:00 PM on Monday via SR-243 (including a stop at Sentinel Gap to view Columbia River basalt), I-90, SR-18, and I-5.

Join us for this rare opportunity for a close look at the Hanford Site and a chance to taste fine wines of the Northwest! One night lodging, two lunches, one breakfast, and one dinner will be provided.

COST PER PERSON: $175.00
MAXIMUM SIZE: 40 participants
CONTACT: Phil Long, phillip.long@pnl.gov 509-372-6090

Note: You must be a U.S. citizen to participate in this field trip.

Participant may join the trip in eastern Washington provided it is prearranged with the field trip leaders.

FIELD TRIP #2

The Hydrogeology of the Columbia Basin Ground Water Management Area-April 6 & 7

TIME: The trip will begin in Tacoma, at 7am on April 6 and ends in Tacoma approximately at 8pm, April 7.

Kevin Lindsey and Terry Tolan of Kennedy/Jenks Consultants and Mark Nielson of Franklin Conservation District offer to lead a two-day field trip that will examine and discuss the soils, geology, and hydrogeology of the Columbia Basin Ground Water Management Area in south-central Washington. The trip will include visits to: 1) farm and range lands to discuss the results of soil leaching mapping and the range of soil conditions and agricultural practices that contribute to groundwater recharge in the region; 2) outcrops of the suprabasalt sediments where we will review the sedimentary geology and hydrogeology of "shallow" suprabasalt aquifers found in these strata; 3) basalt exposures to discuss how the physical nature of these rocks influence groundwater movement and distribution in the rocks which host important groundwater resources; 4) cataclysmic flood eroded coulees to discuss the effects of these large geomorphic features on the nature and distribution of the aquifers they transect; and 5) areas where folding and faulting influence the lateral continuity of sedimentary and basalt strata and the aquifers these rocks host. The trip will be held before the Symposium, on April 6 and 7. The evening of April 6 trip participants will stay in Moses Lake. Vans will be provided to participants during the trip. For field trip participants coming from the Seattle-Tacoma area, we will arrange for transportation from Symposium to Moses Lake and back.

COST PER PERSON: $125.00 - Includes field trip guide, transportation and overnight accommodations (double occupancy) on April 6 and lunches April 6 & 7. If there is interest, we will try to have a "banquet" style dinner during our night stay in Moses Lake.

MAXIMUM SIZE: 24 particpants
CONTACT: Kevin Lindsey 509-734-9763; Terry Tolan 509-734-9763; Mark Nielson 509-545-8546, ext 3.

FIELD TRIP # 3

Hydrogeology of Tacoma Superfund Sites

TIME: Thursday, April 10, 2003, 1-5:30 (post-lunch)

We will visit two of the remediation projects within the larger Tacoma area Superfund Site- ASARCO and the Tacoma Landfill. At each location, we will get an overview of the hydrogeologic setting, the history of use, and the current challenges confronting those charged with remediation responsibilities under the Superfund program. The overviews and tours will be conducted by on-site scientists who are directly involved in the detailed work of design, implementation, monitoring and assessment of the cleanup efforts.

COST PER PERSON: $30 (includes box lunch)
MAXIMUM SIZE: 25 participants
CONTACT: Dr. Barry Goldstein, goldstein@ups.edu
253-879-3822

Note: All participants will be contacted with information regarding room location for the workshops and departure locations for the field trips.

KEYNOTE BIOGRAPHIES

Dr. Richelle Allen-King - the 2003 Darcy lecturer is an associate professor at Washington State University, has a Ph.D. from the Department of Earth Sciences, University of Waterloo, and a bachelor's degree from the Department of Chemistry at the University of California, San Diego. She has served on committees for the National Research Council and presently serves as a member of the Council's Water Science and Technology Board. She also serves as an associate editor for the journals *Ground Water* and *Water Resources Research*. Dr. Allen-King's research focuses on the geochemical processes that control the fate and transport of contaminants in ground and surface waters. She will offer the lecture: "Ground and Surface Water Contributions to Chemical Mass Discharge: Considering the Problem at Field and Basin Scales." The 2003 Darcy Lecture Series will take Richelle's presentation to dozens of places all over the world.

Francis H. Chapelle received B.A. (Music) and B.S. (Geology) degrees from the University of Maryland, and M.S. and Ph.D. degrees from the George Washington University. He has been a hydrologist for the U.S. Geological Survey since 1979. His research interests center on how microbial processes affect the chemical quality of ground water in both contaminated and pristine environments. He has authored more than 80 scientific papers and a textbook ("Ground Water Microbiology and Geochemistry," John Wiley & Sons, 2000) on these subjects. In addition, he has written a book for the non-specialist "The Hidden Sea" (National Ground Water Association, 2000) describing the history of various mystic and rational approaches to understanding ground-water systems, and how the idiosyncrasies of aquifers often complicates efforts to assess and clean up environmental contamination.

Nadine Romero was the originator and chair of the first Symposium on the Hydrogeology of Washington State. She states, "*But, ideas are worth nothing without the energy and know-how of the hydrogeologists at the Washington Department of Ecology, the USGS and consulting firms state-wide -- this event was undoubtedly their doing and it was based on a single core belief that we needed a formal space to have dialogue and share information on the hydrology and hydrogeology of the Pacific Northwest.*" Nadine worked as a hydrogeologist with the Washington Department of Ecology from 1991 until 1997. In 1998 she formed Ground Water Science Services, LLC in Olympia, Washington and worked as a consultant for 3 years before applying to Harvard University to gain experience in public policy and analyses. She believes more scientists need to formally dip into public policy, "*I think all scientists need to deepen their policy and analytical skills. At the Kennedy School of Government, only a handful of natural resource scientists are studying public policy. Yet, there is so much to be done on the planet. Some 1.3 billion people lack clean water and are below basic human subsistence levels. Broadening our understanding of how governance, political and economic systems work globally is paramount to our scientific performance, and the functioning of a rapidly changing globe.*" Her core courses at Harvard's John F. Kennedy School of Government are in energy, environment, economics and technologic innovation. Nadine received her *A.B.* from Mount Holyoke College, an *M.S.* from Michigan State University and will graduate in Spring of 2002 with a Master's in Public Administration, *M.P.A* from Harvard University.

4th Symposium on the
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SITE POSTERS

Dissolved Pesticide Mass Discharge in a Semi-Arid Dryland Agricultural Watershed at the Field and Basin Scale	*A.N. Simmons and R.M. King, Washington State University; et al.*
A Geologic Source of Arsenic in Washington State Ground Water: A Literature Review	*Jennifer Parsons and Richelle Allen-King, Washington State University*
Rain-on-Snow and Nitrate Transport	*Stephanie McAfee and Robert Edmonds, University of Washington*
Nitrate Distributions in a Portion of the Abbotsford-Sumas Aquifer, Northwest Washington	*Leslie Braverman and Robert Mitchell, Western Washington University*
Predicting the Heterogeneous Distribution of Aquifer Permeability Through Lithofacies Mapping Method	*Kathryn Taylor and Dana Divine, et al., Washington State University*
Groundwater Modeling of the Tacoma Landfill	*Mieke Teitge; Calvin Taylor, Tacoma Public Works; Barry Goldstein, University of Puget Sound*
Evaluation of the Interpretation of Groundwater Elevations and Landslide Slip Surfaces through the Use of Ground Penetrating Radar	*Michael Hutchinson and Bernie Housen, Western Washington University*
Application of LIDAR Terrain Mapping to Flood-Hazard Mapping	*Mark Mastin and Dave Kresch, U.S. Geological Survey*
Quantifying Thermal Variations in Lower Granite Reservoir Using Satellites and 3-D CFD	*Christopher Cook, George He, et al., Pacific Northwest National Laboratory*
Ground-Water Flooding Related to Local Washington Geology	*Myrtle Jones and Joseph Jones, et al., U.S. Geological Survey*
The Hydrogeology of Northern Lummi Island, Washington	*Bill Sullivan and Robert Mitchell, Western Washington University*
Clover Creek Watershed: Using indicators to Monitor the Environmental Health	*Darren Alkire and Courtney Berner, et al., Pacific Lutheran University*
Surface-Water/Ground-Water Interactions Along the Lower Dungeness River and Vertical Hydraulic Conductivity of Streambed Sediments, Clallam County, Washington, September 1999-July 2001	*Bill Simonds, U.S. Geological Survey; Kirk Sinclair, WA Dept. of Ecology*
Preliminary Numerical Modeling of Groundwater Flow on the Swinomish Indian Reservation	*Karen Mitchell, Swinomish Office of Planning and Community Development*
Numerical Simulation of the Ground-Water Flow System of the Colville River Watershed, Stevens County, Washington	*Claire Longpre and Matt Ely, U.S. Geological Survey*
Characterization of Geomorphology and Hyporheic Conditions of Spring Chinook Salmon Spawning Habitat Within the Yakima River Basin	*A. Brooke Asbury, Carey Gazis, and Lisa Ely, Central Washington University*
An Overview of the System Assessment Capability: Inventory and Environmental Transport Simulation	*W.E. Nichols and D.W. Engel, et al., Pacific Northwest National Laboratory*
An Overview of the System Assessment Capability: Software Design and Implementation	*C.T. Kincaid and R.W. Bryce, et al., Pacific Northwest National Laboratory*
System Assessment Capability: Impacts and Uncertainty Analysis	*P.W. Eslinger and C.A. Brandt, et al., Pacific Northwest National Laboratory*
A Systematic Approach for Developing Conceptual Models of Contaminant Transport at the Hanford Site	*G.V. Last and V.J. Rohay, et al., Pacific Northwest National Laboratory*
Multi-Source Influence on Vertical Contaminant Distribution and Transport in a Thick Unconfined Aquifer Beneath the Hanford Site, Richland, Washington	*Bruce Williams and Mary Hartman, Pacific Northwest National Laboratory*
Hanford Tank Farm Vadose Zone Characterization Process and Results	*P.D. Henwood, R.G. McCain, and J.M. Silko, U.S. Dept. of Energy*
Evaluating Potential Sources for Tritium in Groundwater at the 100-K Area, Hanford Site, Washington	*R.E. Peterson and F.A. Spane, et al., Pacific Northwest National Laboratory*
A Comparison of Actual Evapotranspiration Estimates to a Soil Moisture Budget and Plant Growth	*Erick Miller and Peter Bannister, Aspect Consulting, LLC; et al.*